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# 1991 GORDON RESEARCH CONFERENCE ON NONLINEAR OPTICS AND LASERS

## Final Progress Report

AFOSR and NSF Grant No: ECS-9111835  
ONR Grant No: N000-1491J1579

### Summary of Conference Events

The Conference on Nonlinear Optics and Lasers, which is held traditionally every other year, was held again this year. The topics were chosen on the basis of their current interest and of significant advances within the past year: production of X-rays with high power lasers, generation of millimeter waves with femtosecond pulses, microcavities and micro-lasers, second harmonic generation in fibers and advances in photorefractivity and parallel optical processing. It is important to introduce Gordon conferees to ways of thinking and scientific methods in fields that are related, but would not generally appear in specialized conferences. We had three such examples: The methods of nonlinear optics as applied to electronic signal processing (Dave Bloom), the concept of squeezing (special quantum states of the electromagnetic field) as used to explain the generation of gravitational waves in the expanding universe (Leonid Grishchuk), and particle interferometers with particle-instead of wave-gratings (Dave Pritchard).

By asking Nobel laureate Bloembergen one year in advance to give the traditional after dinner speech, we were privileged to hear him speak of the history of optics over the centuries resulting in the various principles of linear optics, and the highly accelerated pace of discovery of the analogous principles in nonlinear optics. His presence was particularly gratifying, since there was a large contingent of graduate students participating in the conference.

We had two foreign cochairman: Profs. E. Hanamura and Prof. E. Göbel. Invited foreign speakers were:

from France:	Prof. Jean-Michel Raimond
from Great Britain:	Prof. Wilson Sibbett
from the Soviet Union:	Profs. Leonid Grishchuk and Boris Zeldovitch
from Germany:	Prof. Theo Tschudi
from Austria:	Prof. Arnold Schmidt

In order to air the work of graduate students, and to give the opportunity to present very recent work, we have had the tradition of a poster session. This year we expanded the poster session to two evenings. This was a very useful innovation. The number of posters each night was of the order of 15, giving plenty of time for extensive discussion with the presenters. This mode is highly recommended for future conference.

At the Thursday conference dinner votes were taken on the "best poster." The winner was "Optical Coherence Tomography," Paper 29 on the poster program. The runner up was "Time Domain Observation of Squeezing in a Nonlinear Fiber Ring Interferometer," Paper 18 on the poster program.

On Tuesday afternoon, the committee consisting of the chairman, vice-chairman, and discussion leaders selected two candidates for vice-chairman of the 1993 conference (and thus chairman of the 1995 conference). In the Tuesday evening session an announcement was made to the conferees that on Wednesday night a vote would be taken on the next vice-chairman and that they should consider presenting candidates. When nominations were made on Wednesday night, the nominee of the conferees was Yaron Silberberg. In the vote, Silberberg was the winner. As chairman of this conference I can express my satisfaction that a very good candidate was chosen and that the 1995 conference planning is in good hands.

At any time during the week, about 90 conferees were present.

The atmosphere in Wolfeboro is beyond compare. I attend many conferences myself, yet I have never found an equally informal and productive setting for the exchange of ideas and the spawning of new ideas. On the whole, it is my opinion that the conference was very successful and I am looking forward to the 1993 conference, hopefully at the Brewster Academy.

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Hermann A. Haus  
Institute Professor  
Massachusetts Institute of Technology  
Chairman, Gordon Research Conference  
on Nonlinear Optics and Lasers, 1991



**PROPOSED BUDGET  
1991 GORDON RESEARCH CONFERENCE**

	GRC	AFOSR	NSF	ONR	TOTALS
<b>1. <u>Conference Fee</u></b>					
Invited Speakers: 24 × 350	1,100	4,000	—	3,300	8,400
Session Chairmen: 9 × 350	2,800	—	—	—	2,800
Junior Faculty, 22 × 350					
Students:	1,000	1,000	4,000	1,700	7,700
<b>2. <u>Travel</u></b>					
Invited Speakers, domestic airfare: 9 × 455 (avg)	100	4,000	—	—	4,100
Invited Speakers, foreign airfare: 6 × 1,000 (avg)	6,000	—	—	—	6,000
Junior faculty, students, cochairmen: 10 × 300	—	1,000	2,000	—	3,000
Local transportation, bus from Logan airport to Wolfeboro 28 × 25	1,000	—	—	—	1,000
<b>TOTALS</b>	<b>12,000</b>	<b>10,000</b>	<b>6,000</b>	<b>5,000</b>	<b>33,000</b>

**GORDON RESEARCH CONFERENCE  
NONLINEAR OPTICS AND LASERS**

Brewster Academy, Wolfeboro, NH  
July 22-26, 1991

Chairman: **Hermann A. Haus**    Vice Chairman: **Dana Z. Anderson**  
Co-Chairmen: **E. Göbel** and **E. Hanamura**

**Monday, July 22**

Morning

8:30-9:15	D. Auston	<b>J. Feinberg</b> , Discussion Leader Terahertz Radiation from Photoconducting Antennas
9:15-10:00	D. Bloom	Nonlinear Electronics
10:00-10:30	Coffee Break	
10:30-11:15	Y. Silberberg	Photon Echoes in Er-doped Fibers
11:15-12:00	C. Rhodes	Interaction of High Intensity Radiation with Molecules and Solids

Evening

8:00-8:45	G. Mourou	<b>R. Falcone</b> , Discussion Leader Ultraintense Lasers and Nonlinear Optics of Free Electrons
8:45-9:30	S. Szatmári	Up-scaling of TW-class KrF Lasers

**Tuesday, July 23**

Morning

8:30-9:15	D. Steel	<b>E. Göbel</b> , Discussion Leader High Resolution Nonlinear Spectroscopy and Photon Echoes of Localized Excitons
9:15-10:00	T. Fukuzawa	Luminescence of Type-II Excitons in Coupled Q.W.'s
10:00-10:20	Coffee Break	
10:20-11:05	J. Shah	Subpicosecond Coherent Spectroscopy of Optical Waveguides
11:05-11:50	J. Stark	Nonlinear Optical Response of Strongly Confined Excitons
11:50-12:30	W. Knox	Femtosecond Quantum Well Opto-electronics

Evening

7:30-8:15	M. Murnane	<b>C. Rhodes</b> , Discussion Leader X-rays from Short-pulse Laser Produced Plasmas
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**POSTER SESSION TUESDAY EVENING**

# POSTER SESSION I TUESDAY EVENING

1. "Ten Hertz laser generation of sub-Angstrom X-rays," J. D. Kmetec, C. L. Gordon III, and S. E. Harris, Stanford University.
2. "X-ray resonant nonlinear effects in plasma," A. E. Kaplan and P. Shkolnikov, The Johns Hopkins University.
3. "Relativistic pulse compression," H. C. Kapteyan and M. M. Murnane, Washington State University.
4. "Ultra-short pulse formation in passively mode-locked fiber lasers," M. E. Fermann and M. Hofer, Technical University of Vienna.
5. "Femtosecond desorption of molecules from surfaces: CO/Cu(111)," H. W. K. Tom, J. A. Prybyla and G. D. Anniller, AT&T Bell Laboratories.
6. "Probing the vibrational contribution to  $\chi^{(3)}$  with femtosecond optical pulses," W. T. Lotshaw, C. P. Yakymyshyn, and P. K. Singh, General Electric Company.
7. "Photon echo in strongly saturated systems," V. L. da Silva, Y. Silberberg, J. P. Heritage and E. W. Chase, Bellcore.
8. "Ultrafast behavior of a nonlinear Fabry-Perot etalon," J. Paye and D. Hulin, École Polytechnique - École Nationale Supérieure de Techniques Avancées.
9. "Harmonic mode-locking of a Nd:BEL laser using a 20 GHz dielectric resonator/optical modulator," A. A. Godil, A. S. Hou, B. A. Auld, D. M. Bloom, Stanford University.
10. "Practical limitation of optical parametric oscillators," K. L. Schepler, Wright Laboratory.
11. "Biexciton AC Stark splitting in CuCl," R. Shimano and M. Kuwata-Gonokami, University of Tokyo.
12. "Near infrared dispersion of  $\chi^{(3)}(3\omega)$ ,  $\text{Im}[\chi^{(3)}(-\omega; \omega, \omega, -\omega)]$  and  $\chi^{(3)}(2\omega_1 - \omega_2)$  of poly (4-BCMU) thin films," W. E. Torruellas, K. B. Rochford, R. Zanoni, S. Aramaki and G. I. Stegeman, University of Florida, CREOL.
13. "Optical nonlinear response and the generation of PCW in disordered exciton systems," N. Taniguchi and E. Hanamura, Univ. of Tokyo.
14. "Nonlinear Compton scattering in focused pulsed laser," U. Moludeen, H. W. K. Tom, R. R. Freeman, J. Bokor, P. H. Bucksbaum, AT&T Bell Laboratories.
15. "High-power femtosecond optical pulse compression using spatial solitons," D. H. Reitze, A. M. Weiner and D. E. Leaird, Bellcore.
16. "Picosecond transient photorefectance measurements of heavily ion-implanted and annealed silicon," S. C. Moss, J. E. Wessel, and J. F. Knudsen, The Aerospace Corporation.
17. "Effects of chirp on coherent measurements: the case of the optical Stark effect in semiconductors," J. J. Baumberg, R. A. Taylor and J. F. Ryan, Oxford University.

**POSTER SESSION II  
WEDNESDAY EVENING**

- 18 "Time domain observation of squeezing in a nonlinear fiber ring interferometer," K. Bergman, Massachusetts Institute of Technology.
19. "Two-photon correlation of squeezed pulse train," T. Kuga, Y. Miyamoto, T. Hirano and M. Matsuoka, University of Tokyo.
20. "Spatial dark soliton stripes and grids," G. A. Swartzlander, Jr. Naval Research Laboratory.
21. "Transoceanic fiber transmission that overcomes the Gordon-Haus limit," A. Mecozzi, Y. Lai, and H. A. Haus, Massachusetts Institute of Technology.
22. "Quantum frequency conversion: experimental evidence," P. Kumar and J. Huang, Northwestern University.
23. "High-nonlinearity optical fibers," D. L. Weidman, J. C. Lapp, and M. A. Newhouse, Corning Incorporated.
24. "Holographic mode structure in waveguides," D. Brady, University of Illinois, Champagne-Urbana.
25. "A self-organizing photorefractive demultiplexer," M. Saffman, C. Benkert and D. Z. Anderson, University of Colorado.
26. "Self-organizing feature extraction by a photorefractive system," D. Montgomery, C. Benkert and D. Z. Anderson. University of Colorado.
27. "Photorefractive gratings in KLTN," R. Agranat, Hebrew University of Jerusalem.
28. "All optical ultrafast serial-to-parallel conversion using excitonic giant nonlinearity," K. Ema, M. Kuwata-Gonokami, T. Saiki, K. Takeuchi, and F. Shimizu, University of Tokyo.
29. "Optical coherence tomography," D. Huang, E. A. Swanson, C. P. Lin, J. S. Schuman, W. G. Stinson, W. Chang, M. R. Hee, T. Flotte, K. Gregory, C. A. Puliafito, and J. G. Fujimoto, Massachusetts Institute of Technology.
30. "Coherent detection of the AC Kerr effect by pump-probe prism coupling in semiconductor doped glasses," B. J. Offrein, H. J. W. M. Hoekstra, T. H. Hoekstra, A. Driessen and T. J. A. Popma," Technical University of Twente.
31. "Observation of intermode correlation in whispering gallery mode laser with dye doped micro sphere," M. Kuwata-Gonokami, K. Ema and K. Takeda, University of Tokyo.

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